Serial No. 09/803,941

REMARKS

Claims 1-7, as amended, remain herein.

Paragraph [0025] is amended to correct the spelling of "words." Other minor, self-evident changes have also been made in that paragraph.

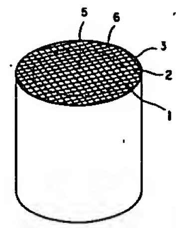
1. Claims 1-7 were rejected under 35 U.S.C. 112, second paragraph, as vague and indefinite because the phrase "in a direction of a diameter" is said to be confusing. Applicant disagrees and explains why below.

Specification paragraph [0020] contains a discussion of how, when the honeycomb is extruded, a kaolin crystal and a cordierite crystal will have different orientations. As discussed in that paragraph at page 8, lines 16-19:

> A thermal expansion coefficient of the cordierite crystallization is different depending on directions, that is, $+2.9\times10^{-6}/^{\circ}C$ in a direction of a diameter and $-1.1\times10^{-6}/^{\circ}C$ in a longitudinal direction.

To identify properly the thermal expansion coefficient, it is necessary to specify one of the two directions, either that of a diameter or a longitudinal direction. See Fig. 1(a) copied below:

FIG.1(a)



The two directions discussed above are (1) a longitudinal direction from the top to the bottom or (2) a perpendicular, sideways direction across the diameter which the specification refers to as "in a direction of a diameter." Applicant submits that an artisan, upon reading paragraph [0020], understands this nomenclature and the meaning of the term "in a direction of a diameter" is clear. To further clarify that the coefficient is that coefficient in the direction of the diameter, this clause is now set off by commas.

If the Examiner prefers other terminology, e.g., "in a radial direction," applicant is so willing to amend the claim.

2. Claim 3 was objected to because there was no space between "0.1" and "mm." Claim 3 is amended as requested and thus this rejection is moot.

3. Claims 1, 2, and 4 were rejected under 35 U.S.C. 102(b) as anticipated by Hamaguchi et al. '275. This rejection is traversed.

The present invention involves modifying a ceramic honeycomb so the thermal expansion of the outer circumferential wall is greater than the thermal expansion coefficient of an inside partition wall portion. This structure causes stress to be applied to the inside partition wall portion from the outer circumferential wall portion as described in Paragraph [0025].

The advantage of the claimed structure also is described in Paragraph [0025]: the thermal shock resistance is increased, making it much harder to cause a thermal rupture of the honeycomb.

Hamaguchi et al. '275 teaches introduction of activated alumina inside the partition walls of a cordierite honeycomb structural body. These honeycomb bodies have smaller degradation of thermal shock resistance by coating a high specific surface area-possessing material having a higher coefficient of thermal

expansion than that of the cordierite carrier and a catalytic component of the carrier. See col. 3, lines 12-20. Hamaguchi et al. '275 provides no teaching or suggestion that the thermal expansion coefficient of the outer circumferential wall is to be greater than the thermal expansion coefficient of the inside partition wall portion. Accordingly, review and withdrawal of this rejection is requested.

4. Claims 1, 2, and 6 are rejected under 35 U.S.C. 102(b) as anticipated by Machida et al. '446. This rejection is traversed.

Machida et al. '446 teaches eliminating the wasteful use of a catalyst by selectively sealing incomplete cells at an outermost peripheral portion of a honeycomb structural body with ceramic materials; see the Abstract.

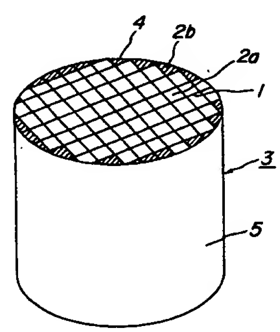
Machida et al. '446 provides no teaching or suggestion that the thermal expansion coefficient of the outer circumferential wall is to be greater than the coefficient of the inside partition wall portion. Accordingly, review and withdrawal of this rejection is requested.

The Examiner contends that the materials and process used are the same as applicant and thus the characteristics of claim 1 would

be expected to be similar absent any evidence to the contrary. However, the portion of the reference cited by the Examiner, namely col. 6, lines 5-26, merely describes how to examine the cell stuffing areas and how to test the catalyst-loading capability. This cited section describes a two-step process.

First, the stuffing rate was examined on the randomly selected ten specimens. After confirming the absence of the stuffing (stuffed) portions in the honeycomb structural bodies, the upper side surfaces of the outer circumferential portion of the honeycomb structure were sealed by the silicon rubber sponge to prepare for the catalyst loading, as shown in Fig. 2 of Machida et al. '446, copied below.

FIG. 2



Then, as described in col. 6, lines 18-31, the catalyst was applied in the form of a slurry. The resulting catalyst carrying performance was evaluated as shown in Table 1.

In the present invention, on the other hand, the thermal expansion coefficient of the outer layer is increased by adding additional material to the outer periphery of the extruded honeycomb. This increase can be accomplished simply by applying additional material to the outer periphery of an already extruded honeycomb as illustrated in Fig. 1(b) copied below. Another way to achieve an increase is to grind off part of the outer region of an extruded honeycomb and then apply additional material to the remaining outer periphery as illustrated in Fig. 2(b) copied below.

FIG.1(b)

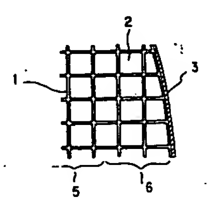
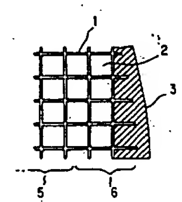


FIG.2(b)



The first technique is described at page 12, lines 16 to page 13, line 3, of the present specification; in that instance, the extruded thickness of the outer circumferential wall portion is 0.25 mm. The same raw material was then slurried and applied on the outer circumferential wall portion as shown in Figs. 1(a) and

1(b) to provide an outer wall thickness of about 1.25 mm. The data in Table 2 show the superior results obtained. Applicant's process of making is unique and the resulting products form an entirely different structure from that of Machida et al '446. There clearly is no teaching of the instant invention from Machida et al. '446.

Claims 2 and 6 further define preferred features of the resulting ceramic honeycomb structure and are patentable for the same reasons that claim 1 is patentable.

5. Claims 1 and 2 were rejected under 35 U.S.C. 103(a) as unpatentable over Kotani et al. '067 in view of Kumazawa et al. '899. This rejection is traversed.

Kotani et al. '067 relates to a a ceramic honeycomb structure with grooves and an outer coating. The Office Action describes the reference thusly:

> Kotani further teaches an outer coating formed on the outer surface of the body to reduce cells from cracking (see col. 2, lines 28-38) but is silent to the thermal expansion coefficient of the outer coating on the body wall being larger than the thermal expansion coefficient of an inside partition wall.

After describing the secondary reference Kumazawa et al. '899 below, the Examiner contends that it would have been obvious to include the gamma-alumina of Kumazawa et al. '899 in the Kotani et

al. '067 coating composition because the gamma-alumina would provide excellent thermal shock resistance.

The critical question regarding the proposed combination of references in this rejection is why would an artisan want or have any reason to provide thermal shock resistance to the structures of Kotani et al. '067? The coating is applied in Kotani et al. '067 to reduce cell cracking. But such cracking is not disclosed to be due to subsequent thermal treatments which are provided by thermal stress or thermal shock. Instead the cracks are formed due to the low mechanical strength of the honeycomb structure (green body) during extrusion. See col. 2, lines 12-29. Thus, there is no motivation to combine the features of Kumazawa et al '899 relating to thermal shock resistance with Kotani et al. '067, which does not employ its coating for any thermal shock resistance reasons.

Kumazawa et al. '899 relates to a ceramic honeycomb catalyst having an excellent thermal shock resistance in which a carrier is coated on a ceramic honeycomb structural body, the catalyst having a mean thermal expansion coefficient in a range from 40° to 800°C. of smaller than $0.7 \times 10^{-6}/°C$. See the Abstract. This result of having excellent thermal shock resistance is achieved by heat

treating a carrier-coated ceramic honeycomb structural body at a temperature of 900°-1100°C.

Kumazawa et al. '899 merely teaches how to reduce the increase in the thermal expansion coefficient when the catalyst is loaded because the thermal expansion coefficient increases when the catalyst is loaded. Applicant finds no teaching in the portion of Kumazawa et al. '899 cited by the Examiner (Table 1 and col. 3, line 65 to col. 4, line 46) that:

> the thermal expansion of the inner body is smaller than the thermal expansion coefficient of the outer carrier coating (which is on the outer body wall).

Indeed, Kumazawa et al. '899 is silent regarding the thermal expansion coefficient difference between the inside partition wall portion and the outer circumferential wall portion.

Thus applicant submits that there can be no proper combination of these two references to lead to the honeycomb structure of claims 1 and 2. Accordingly, review and withdrawal of this rejection is requested.

6. Claims 4 and 5 were rejected under 35 U.S.C. 103(a) as unpatentable over Machida et al. '446 in view of Kotani et al. '067. The rejection is traversed as well.

As discussed previously, Machida et al. '446 provides no teaching or suggestion that the thermal expansion coefficient, when measured in the diameter direction, of the outer circumferential wall is to be greater than the coefficient of the inside partition wall portion.

As discussed previously, Kotani et al. '067 fails also to teach or suggest the presently claimed thermal expansion coefficient relationship between the outer circumferential wall and the inside partition wall portion. Accordingly there can be no proper combination of these two references to render obvious the subject matter of claims 4 and 5 which depend from claim 1. Review and reconsideration of this rejection are requested.

7. Claims 3-5 were rejected under 35 U.S.C. 103(a) as unpatentable over Machida et al. '446 in view of Kotani et al. '067 and further in view of Beauseigneur et al. '722. This rejection is traversed as well.

The deficiencies of Machida et al. '446 and Kotani et al. '067 in combination to suggest the claimed honeycomb structure have been discussed previously.

Beauseigneur et al. '722 is cited for disclosing several examples of honeycomb structures having a range of the numbers of cells per unit area values and typical wall thickness requirements as recited in instant claims 3-5. However, because Beauseigneur et al. '722 provides no teaching or suggestion that the thermal expansion coefficient, when measured in the diameter direction, of the outer circumferential wall is to be greater than the coefficient of the inside partition wall portion, Beauseigneur et al. '722 cannot overcome the deficiencies of the two primary references. Accordingly, there can be no proper combination of these three references to deny patentability to claims 3-5.

It appears claim 7 is also rejected over these three references; see Paragraph 13 of the Office Action. However, because claim 7 depends from claim 1, claim 7 is also patentable because the three references fail to teach the basic honeycomb structure of claim 1. The rejection should be withdrawn.

Applicant respectfully submits that the application is now in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for all pending claims.

Should the Examiner deem that any further action by applicant would be desirable for placing this application in even better condition for issue, the Examiner is requested to telephone applicant's attorney at the number listed below.

Respectfully submitted,

PARKHURST & WENDEL, L.L.P.

August 22, 2002

Date

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Attachment: Marked-Up Version

Attorney Docket No.: WATK:210

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Marked-up Version

IN THE SPECIFICATION:

Please cancel Paragraph [0025] and replace with:

[0025] When hot exhaust gas is suddenly sent in an automobile exhaust gas purification apparatus in which a ceramic honeycomb structure is arranged, a difference in temperature between [in] a central portion and [in] an outer circumferential portion is generated, and a thermal shock is applied to the ceramic honeycomb structure. The central portion of the ceramic honeycomb structure becomes hot and is going to expand at this time. However, it cannot expand because the outer circumferential portion is at normal temperature. Therefore, internal pressure is applied, and a tensile load is applied to the outer wall. Generally, [ceramics] a ceramic is relatively weak against a tensile load [though] , although it is strong against a compression load. Therefore, in the case [that] where a tensile load in an outer circumferential portion due to temperature distribution exceeds rupture strength of a ceramic honeycomb structure, the ceramic honeycomb structure is ruptured. To the contrary, in the ceramic honeycomb structure where the outer circumferential wall portion 3 is subjected to the

specific reinforcement of the present invention, a thermal expansion coefficient of the outer circumferential wall portion 3 is larger than that of the inside partition wall portion 5 in a direction of a diameter. In other words [wards], the outer circumferential wall portion 3 is in a compressed state, and stress is applied [toward] towards the inside partition wall portion 5. That is, since a tensile load is not applied until a tensile load larger than this stress is applied, the outer circumferential wall portion 3 in a compressed state like the present invention [have] has a weaker outbreak tensile load in comparison with an outer circumferential wall portion of a normal ceramic honeycomb structure, thereby thermal shock resistance is increased, and rupture is hard to be caused.

IN THE CLAIMS:

Please amend claims 1 and 3 as follows:

1. (Amended) A ceramic honeycomb structure comprising a plurality of through-holes surrounded by partition walls, wherein a thermal expansion coefficient of an outer circumferential wall portion in the ceramic honeycomb structure is larger than a thermal

expansion coefficient, in a direction of a diameter, of an inside partition wall portion in the ceramic honeycomb structure, and stress is applied to the inside partition wall portion from the outer circumferential wall portion.

3. (Amended) A ceramic honeycomb structure as defined in claim 1, wherein a partition wall of the ceramic honeycomb structure has a thickness of less than 0.1 mm [0.1mm].